

Update on Requirements

37th Geant4 Technical Forum
March 20th 2014

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On behalf of the Geant4 Collaboration

Requirements Tracking System Page:
<http://jirageant4.kek.jp/secure/Dashboard.jspa>

NEW REQUIREMENTS

FROM LAST TF (DECEMBER)

3601 : “white list” of particle types

- Originator: ATLAS
- Issue
 - Generators sometimes produce particle types that Geant4 does not know about and can not track.
- Request:
 - Have a “white list” of particle types that Geant4 can track
- Responsible :
 - Makoto Asai
- Status:
 - Has been provided.
 - Closed.

3602 : Optimize structure of Geant4 libraries

- Originator: CMS
- Issue:
 - Current Geant4 consists of 23 shared libraries of different sizes
 - Process library is 10 times larger than any other library
- Request:
 - To consider alternatives and evaluate their performances:
 - Split process library in several pieces
- Responsible :
 - Physics groups (for specifying meaningful granularity) and Ben Morgan
- Status:
 - On going.
 - **Open.**

NEW REQUIREMENTS

FROM SECOND LPCC WORKSHOP, YESTERDAY.

**(THESE REQUIREMENTS ARE ASSIGNED TO THIS TF,
PARTIAL CAPTURE ONLY, NOT FINISHED.)**

3701 : Use of Geant4e in track fitting

- Originator: CMS
- Issue:
 - Geant4e is being used by CMS for track fitting:
 - With a forward propagation phase, called “fitter”
 - Followed by a backward propagation, called “smoother”
 - Backward tracking requires the momentum to be flipped, changing the error matrix accordingly
- Request:
 - Improve documentation addressing the case of Kalman fitter scenario (forward & backward) propagation.
 - An automated mode to perform backward propagations in Geant4e:
 - Flip momentum
 - Take care of the error matrix transformation
 - Take care of the error handling
- Responsible:
 - Pedro Arce
- Status:
 - New, to be discussed.
 - Note MT migration of Geant4e has to be done.
 - **Open.**

OPEN REQUIREMENTS

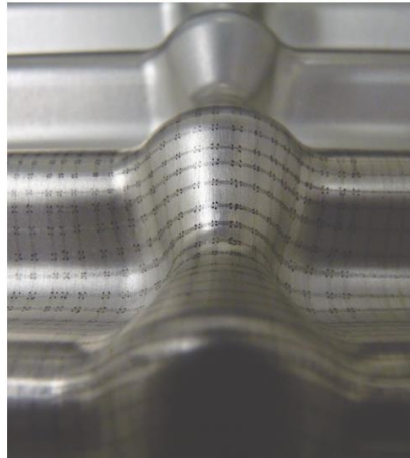
2902: Displacement in thin volumes

- Originator: S. Miglioranzi (LHCb)
- Issue
 - Displacement lost for steps in thin vol. (Si layers)
 - Need to recover displacement for all charged particles (not just e-, as in EM opt 3)
 - Need to avoid extra CPU cost.
- Responsible :
 - Vladimir Ivantchenko
- Steps in addressing issue:
 - On Geant4 side:
 - Customized physics List based on EM Option-0, limiting all charged particles' steps was provided.
 - In 9.5 EM option2 includes WentzelVI MSC model, alternative approach for scattering of hadrons.
 - Default MSC for all particles (including e+- above 100 MeV) changed from Urban model to WentzelVI
 - On LHCb side:
 - Significant invest in LHCb geometry for better description on-going.
- Status:
 - From 2nd LPCC workshop:
 - RF foil description in front of VELO detector has been improved
 - Significantly reduces the discrepancy
 - **Propose to close.**

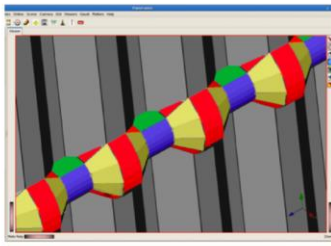
From 2nd LPCC workshop

Determining the variation in thickness

- A flat foil is marked with a grid of pencil lines
- The foil is then pressed into shape
- The lines can then be used to determine how stretched the various regions are

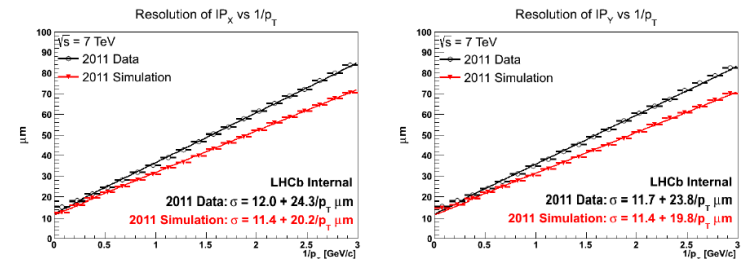


Thickness scaling factors



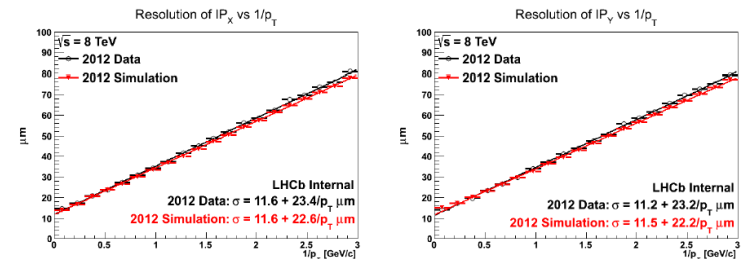
Shape	Scratch	Old Sim
red	0.84	0.6
yellow	0.86	0.6
blue	0.95	0.6
side-gr	0.73	0.6
side-r	0.80	0.6
wing-r	0.95	1.0
wing-y	0.75	1.0
wing-b	0.75	1.0

2011 data vs simulation



- IP_x and IP_y resolution vs $1/P_T$. 2011 data and MC from 2011-2012 productions (Sim05)
- This was an open problem presented in the last LPCC workshop

2012 data vs simulation



- 2012 data and MC from 2013 productions (Sim08) show much better agreement
- RF-foil description update responsible for most of the change. 2012 agreement still better than 2011 due to other tuning factors

Note: Change of gradient in data is likely due to introduction of new RF foil model \rightarrow change in multiple scattering description used for reconstruction.

3301 : Multithreading processing driven by experiment framework

- Requester: CMS
 - Original request at 33th TF ([link](#))
 - Further information at G4 Collaboration meeting ([link](#))
- Responsibles:
 - Andrea Dotti, Makoto Asai, John Apostolakis.
- Scope:
 - To process multiple events and process multiple modules in same event (gen., sim./G4, trg., reco., ana.) simultaneously
 - Geant4 = one of the modules
 - Framework controls modules execution
 - Geant4 to be controlled with proper messages
 - “Threading Building Blocks” (Intel® TBB) task model adopted
- Status:
 - Strong communication/feed-back going on with 10.0.
 - **A mini-workshop has been proposed at LPCC: 12 & 13 of May, at CERN.**
 - **Open.**

3404 : Change of AtRest logic for allowing stopped tracks to be accelerated and further tracked

- Requester: Tom Roberts, Muon Inc.
 - Description: Tracks that come at rest are always killed
 - But in presence of an electric field, for example, a stopped charged track maybe accelerated.
- Responsible:
 - Marc Verderi (was Takashi Sasaki).
- Requirement:
 - Allow for AtRest track with fStopButAlive status to be put back as fAlive status.
- Use-cases (so far):
 - Inverse cyclotron: frictional cooling to stop muons before acceleration by electric field.
 - Collective tracking: mutually interacting tracks tracked in small time steps. Some may stop at some point and be restarted: not possible with current AtRest logic.
- Status:
 - Approach considered : have an AtRest process for dealing with such cases.
 - Difficulty for this process is with time-dependent fields
 - To be limited to some particle types (eg: no e-)
 - **Open**

3405 : Extensible physics list factory

- Requester: Robert W. Hatcher, for FNAL neutrino experiments
 - If a user defines a physics list, there is no way to make it known by the physics list factory
 - If a user defines a physics module (eg monopole), there is no way to combine such module with existing physics lists
- Responsible:
 - Gunter Folger
- Requirements:
 - Allow the physics list factory to be extensible with user-made physics list
 - Allow for user physics module / extension (eg monopole) to be combined with existing physics lists
- Status:
 - A « generic physics list » mechanism has been put in place, with one example; expected to resolve the problem.
 - Will be confirmed soon and documented
 - Open

3502 : Correct Kaon asymmetry in cross-sections

- Requester: LHCb
 - LHCb observes a kaon asymmetry which is too low, specially at high energy.
- Responsible:
 - Witold Pokorski
- Proposed solution:
 - LHCb will measure and provide the correct cross-section asymmetry.
- Status:
 - Progress advertised at 2nd LPCC workshop :
 - measurement on-going, in approval yesterday
 - to appear in arXiv soon.
 - **Open.**

RECENTLY CLOSED REQUIREMENTS

3403 : Indicate when Geant4 does or does not take ownership of pointers

- Requester: MU2e
 - Description: The MU2e experiment is driving the Geant4 loop in its framework and needs to have clarifications on when Geant4 takes or not ownership on pointers.
- Responsible:
 - Michael Kelsey
- Status:
 - The philosophy of ownership is documented for the most user-exposed classes, as part of the 10.0 release.
 - Users are invited to tell if the proposed documentation responds to their expectation.
 - Closed.

3501 : Materials with same names but different properties

- Requester: Mu2e experiment
 - A material with same name can be constructed several times, properties can even be different, but this happens silently.
- Responsible:
 - Vladimir Ivantchenko
- Proposed solution:
 - Issue a warning in case a same name material is created.
- Status:
 - Has been provided in 10.0.
 - Warning can be switched off by user.
 - Closed.